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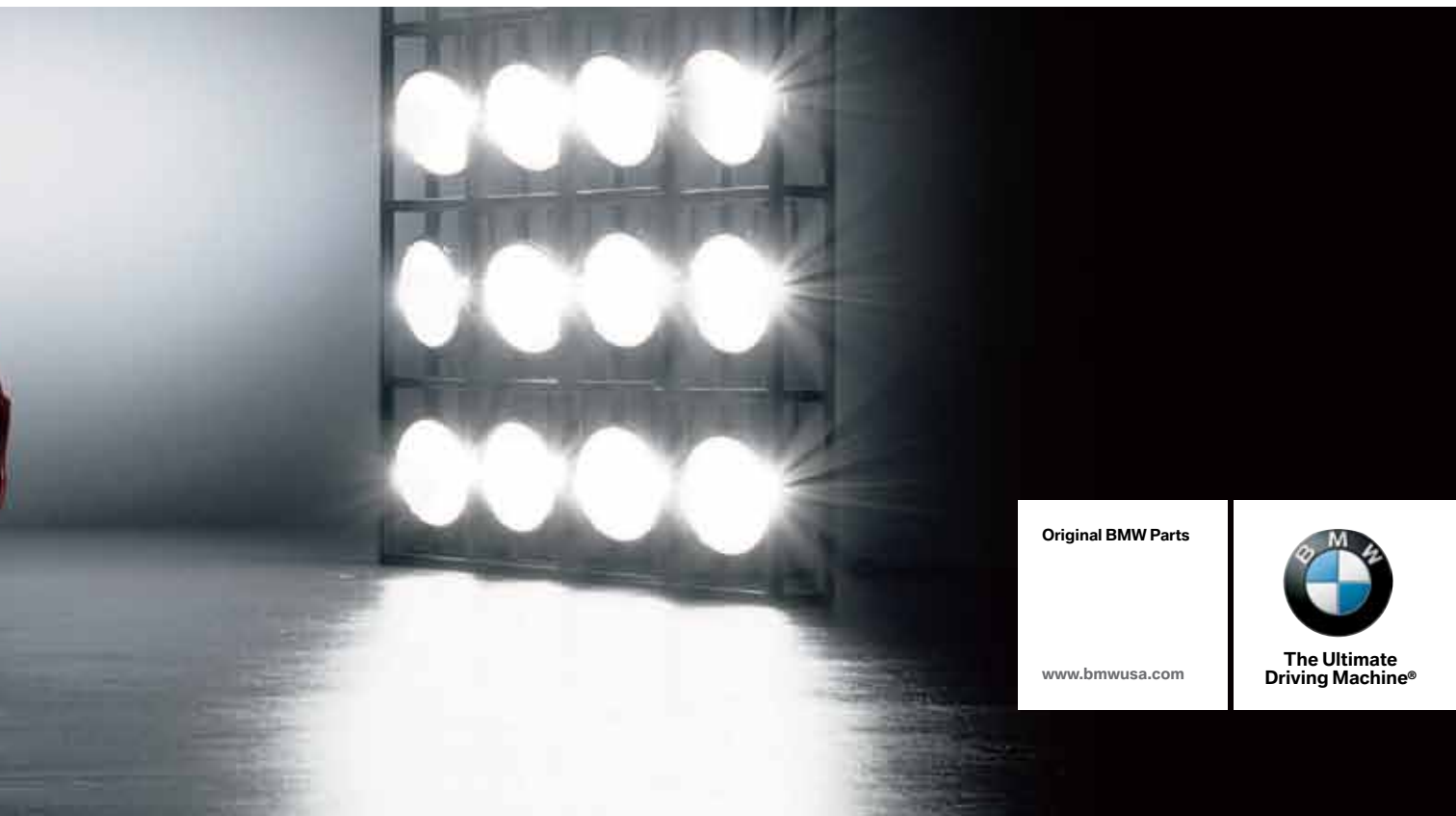

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Christopher M. Ayers, Jr.
President/Publisher: cayers@mastertechmag.com

Bob Freudenberger
Editor: bfreud@mastertechmag.com

John Anello • Steve Campbell • Paul Cortes
Kerry Jonsson • Phil Fournier • Chip Keen
Greg McGoniga • Tony Molla • Tom Nash
Henry Olsen • Matt Ragsdale • Dave Russ
Contributing Editors: bfreud@mastertechmag.com

Christopher-Michael Ayers
Art Director, Project Mgr.: ayersc3@mastertechmag.com

Joann Turner
Circulation Manager: jturner@mastertechmag.com

Editorial, Circulation,
Advertising Sales and Business Office:
Master Technician Magazine
486 Pinecrest Rd. • Springfield, PA • 19064
P.484.472.8441 • F.484.472.7460

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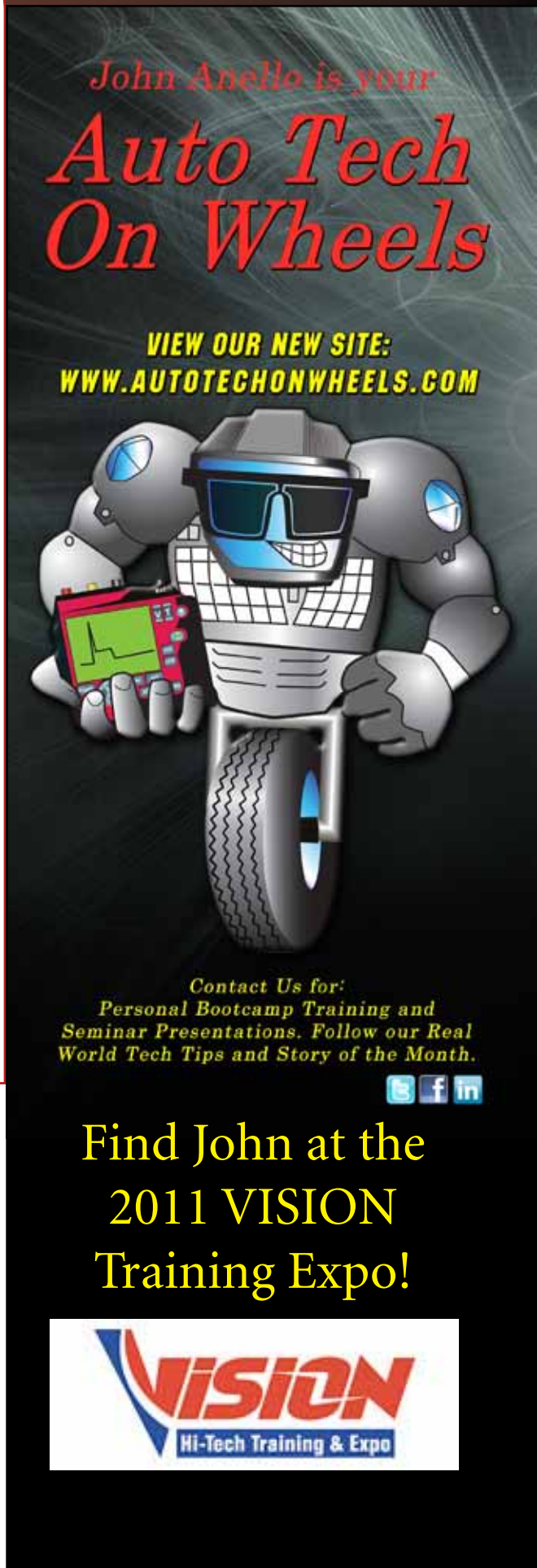
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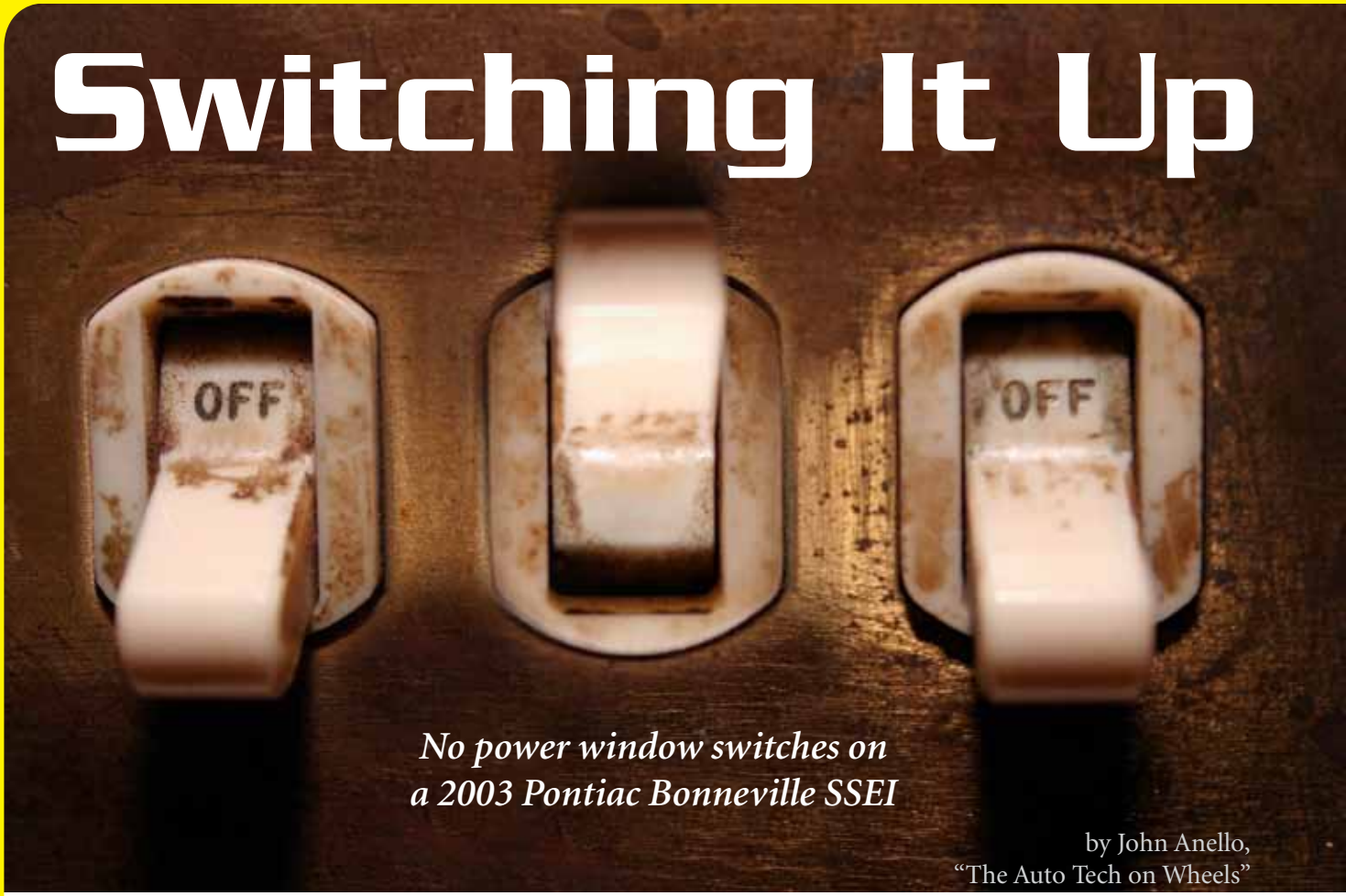
Switching It Up



No power window switches on a 2003 Pontiac Bonneville SSEI

by John Anello,
"The Auto Tech on Wheels"

I was called in to a shop for a complaint of no power window operation on a 2003 Pontiac Bonneville SSEI (Figure 1). They had already checked the power and ground feeds at the driver door master switch and everything seemed okay. The odd thing was that the other door windows would not operate from their individual switches. It was just hard to believe that this vehicle could have four bad window switches. The window motors all worked okay when power and ground were applied to each motor individually. The garage was uncertain where to turn, so rather than throwing parts at this car they decided to call me in for a second opinion.

Figure 1: 2003 Pontiac Bonneville SSEI.

When I arrived at the shop I verified the complaint by trying each power window switch and nothing responded. I next decided to print out a wiring diagram to familiarize myself with the system layout and see if I could find something in common that would affect power window operation at all four doors, such as a main power or ground feed. As I viewed the diagram, I found out that these were not your everyday "how you doin'" window switches. Instead, they were all separate door control modules. Each module in turn controlled window motor operation through an internal window motor driver. Operating the window switch only created a high/low signal to command the window up or down. The switch no longer had to transmit a power or ground feed to the window motor directly, which made for less wear and tear on the switch contacts.

I used my Paintbrush function in Mitchell to color-code the wiring diagram. I chose green for the grounds, purple for the high-current circuit breaker feed, orange and red for low-current battery feed (Figure 2). The ground feeds for each door module were at different locations, so it was hard to believe that the system had four open grounds. The rear door modules shared the same low-current battery feeds, but the front door modules had two other separate low-current battery feeds, so here too nothing seemed common to all four door modules. Looking a little closer at the diagram, I could see that all four modules did share the same high-current feed from a 30 Amp circuit breaker, so this was the first place I wanted to look.

I used my test light and checked each door module for high-current battery feed, and they all seemed to be okay. The tech said that all the wiring checked okay, and it did, but I still had to see for myself because you just never know. There have been many times when techs have used a logic probe to do a power and ground check without finding anything, yet a bad ground or power feed turned out to be the culprit. They relied on the logic probe's ability to light a green or red LED as a valid check, which only required about 20 mA to light up, but when the ground or power had to step up to the plate to handle a a high-current circuit it would lose it's connection. This is where a standard test light, which can load a circuit up to 300 mA, would be a better choice. Keep in mind, though, that this type of test light cannot be used on computer circuits because it can harm them.

I discovered that the driver door module had the ability to communicate with a scan tool by looking at a data communication wiring diagram (Figure 3), which showed

all the onboard controllers on the serial data network linked to the ALDL connector. So, I hooked up my GM Tech II scan tool to see if there were any trouble codes stored in memory that could lead me in the right direction. Looking at

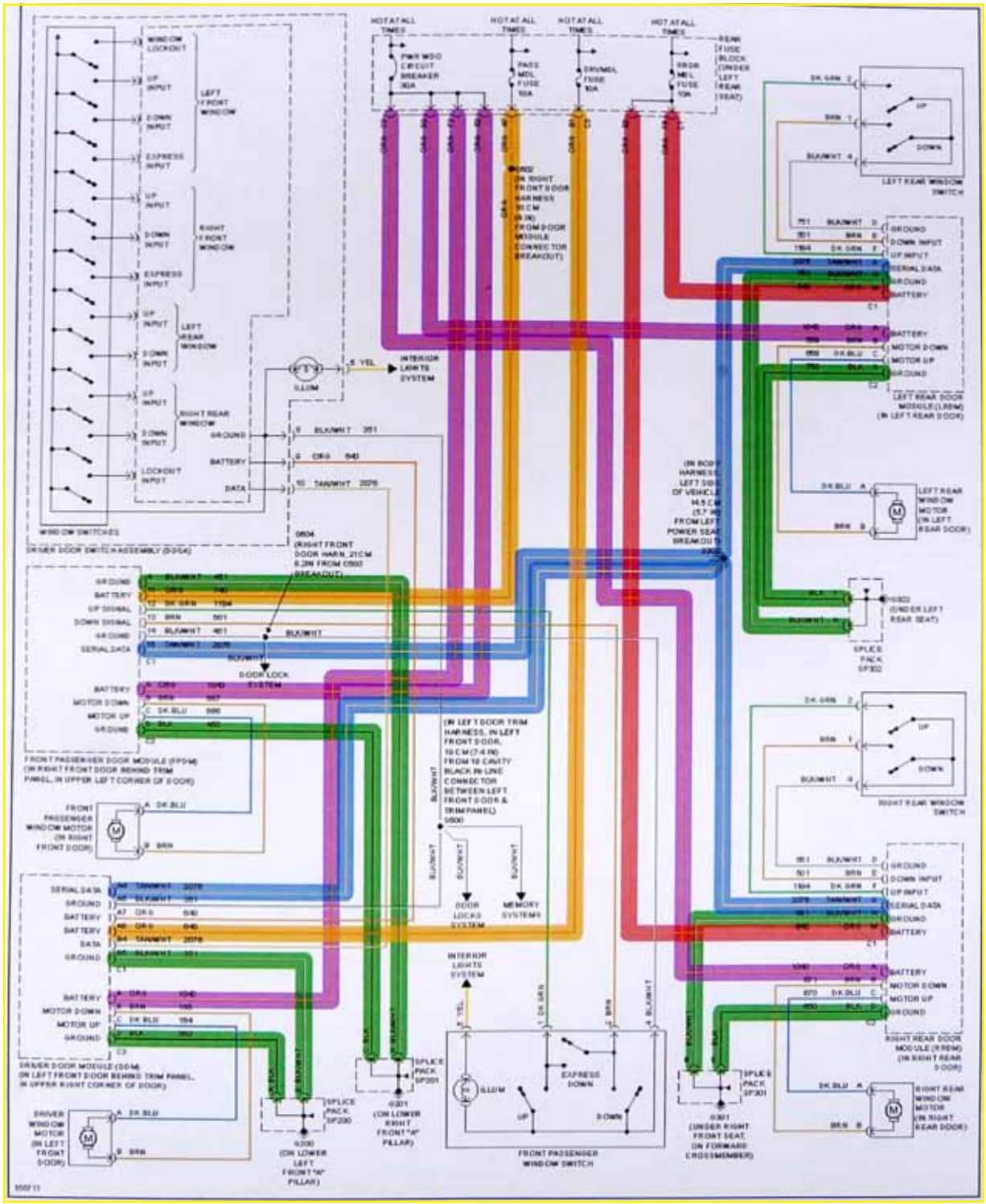
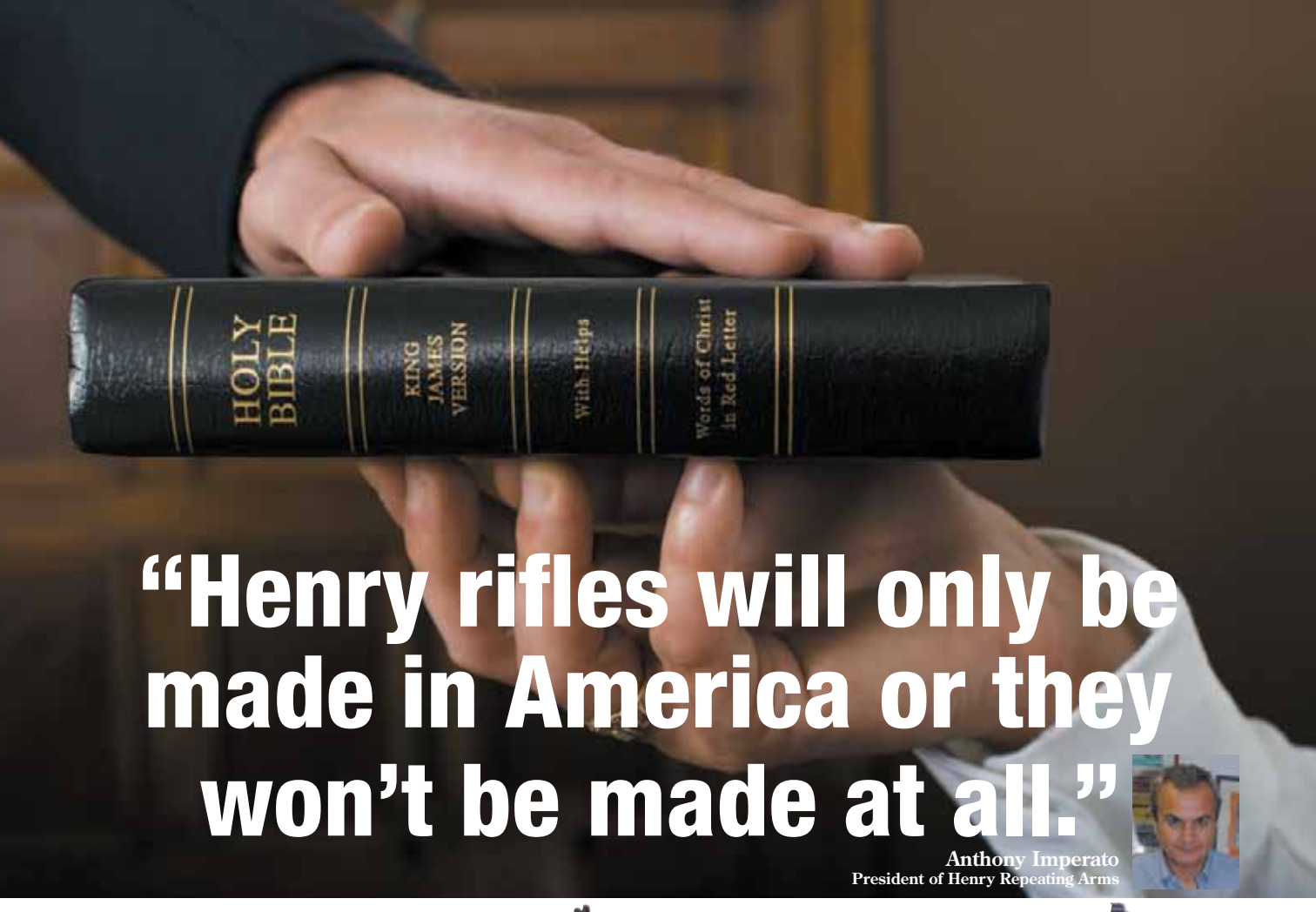


Figure 2: Wiring diagram, color coded: Green = Ground; Purple = High-current Circuit Breaker Feed; Orange & Red = Low-current Battery Feed.



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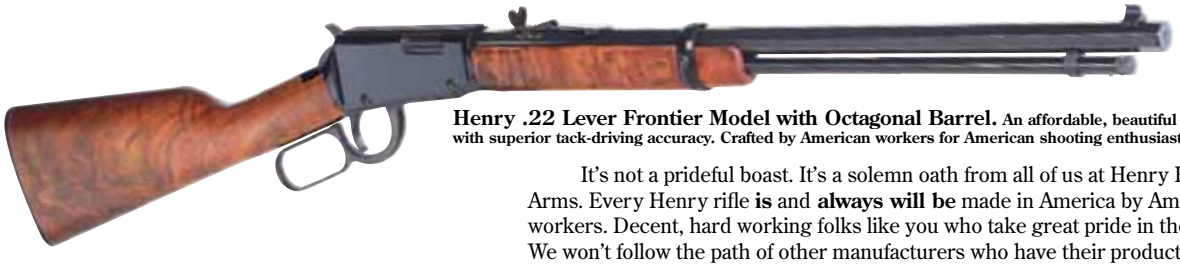

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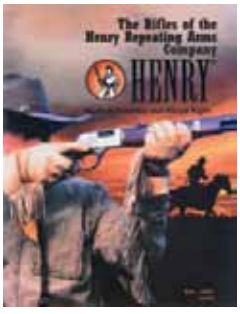

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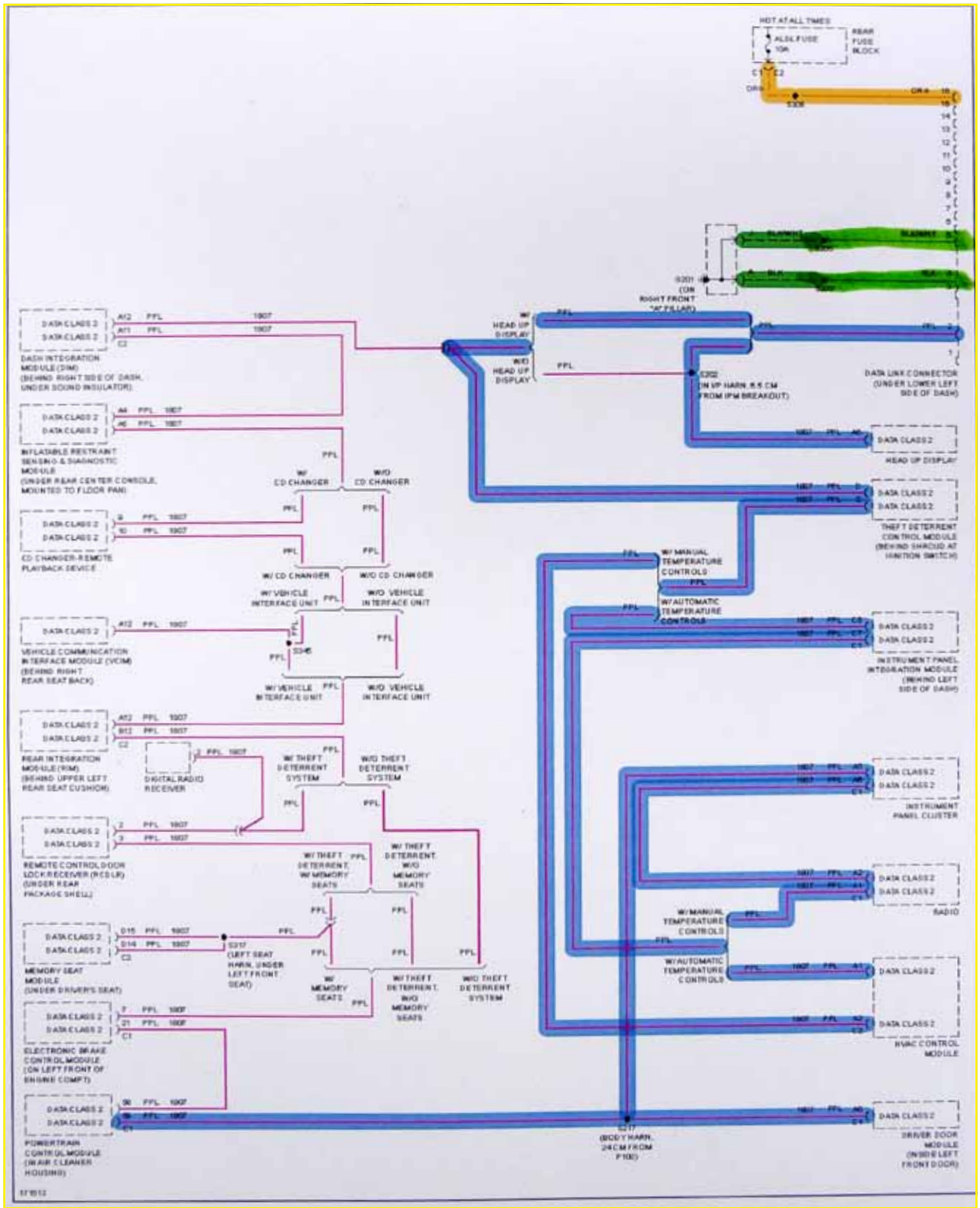
HOT AT ALL TIMES
ALDL FUSE
10A
REAR FUSE BLOCK
DATA CLASS 2
DASH INTEGRATION MODULE (DIM) (BEHIND RIGHT SIDE OF DASH, UNDER SOUND INSULATOR)
INFLATABLE RESTRAINT SENSING & DIAGNOSTIC MODULE (UNDER REAR CENTER CONSOLE, MOUNTED TO FLOOR PAN)
CD CHANGER-REMOTE PLAYBACK DEVICE
VEHICLE COMMUNICATION INTERFACE MODULE (VCIM) (BEHIND RIGHT REAR SEAT BACK)
REAR INTEGRATION MODULE (RIM) (BEHIND UPPER LEFT REAR SEAT CUSHION)
DIGITAL RADIO RECEIVER
REMOTE CONTROL DOOR LOCK RECEIVER (RCDLR) (UNDER REAR PACKAGE SHELF)
MEMORY SEAT MODULE (UNDER DRIVER'S SEAT)
ELECTRONIC BRAKE CONTROL MODULE (ON LEFT FRONT OF ENGINE COMPT)
POWERTRAIN CONTROL MODULE (IN AIR CLEANER HOUSING)
W/ HEAD UP DISPLAY
W/O HEAD UP DISPLAY
DATA LINK CONNECTOR (UNDER LOWER LEFT SIDE OF DASH)
HEAD UP DISPLAY
THEFT DETERRENT CONTROL MODULE (BEHIND SHROUD AT IGNITION SWITCH)
W/ MANUAL TEMPERATURE CONTROLS
W/ AUTOMATIC TEMPERATURE CONTROLS
INSTRUMENT PANEL INTEGRATION MODULE (BEHIND LEFT SIDE OF DASH)
INSTRUMENT PANEL CLUSTER
RADIO
HVAC CONTROL MODULE
DRIVER DOOR MODULE (INSIDE LEFT FRONT DOOR)
W/ CD CHANGER
W/O CD CHANGER
W/ VEHICLE INTERFACE UNIT
W/O VEHICLE INTERFACE UNIT
W/ THEFT DETERRENT SYSTEM
W/O THEFT DETERRENT SYSTEM
W/ THEFT DETERRENT, W/ MEMORY SEATS
W/ THEFT DETERRENT, W/O MEMORY SEATS
W/O THEFT DETERRENT SYSTEM
W/ MEMORY SEATS
S317 (LEFT SEAT HARN, UNDER LEFT FRONT SEAT)
S345
S217 (BODY HARN, 24 CM FROM P100)

Figure 3: Data communication wiring diagram showing all the onboard controllers on the serial data network linked to the ALDL connector.

the scan tool, I pulled some "U" codes of interest (Figure 4). The codes U1161, U1162 and U1163 all pertained to the driver's door module's inability to talk to the other three door modules. There was no access for my scan tool to talk to the other three modules because it was only able to access the mainstream controllers all on one network as seen in the communication link diagram. The door modules had their own private UART network that was shared among them, as can be seen by the blue colored-coded lines in the Power Window Circuit diagram (Figure2). This seemed like a possible culprit if there was damage to this private network.

According to the diagram, there was a splice for this private UART network located under the rug about 14cm from the left power seat breakout. I had the shop remove the front driver's seat, and as I lifted the rug I noticed a lot of rust build-up on the floor from a prior water leak (Figure 5). I next located a conduit that held the splice internally wrapped with black electrical tape (Figure 6). I slowly removed the tape and was surprised to see a Scotch Lock

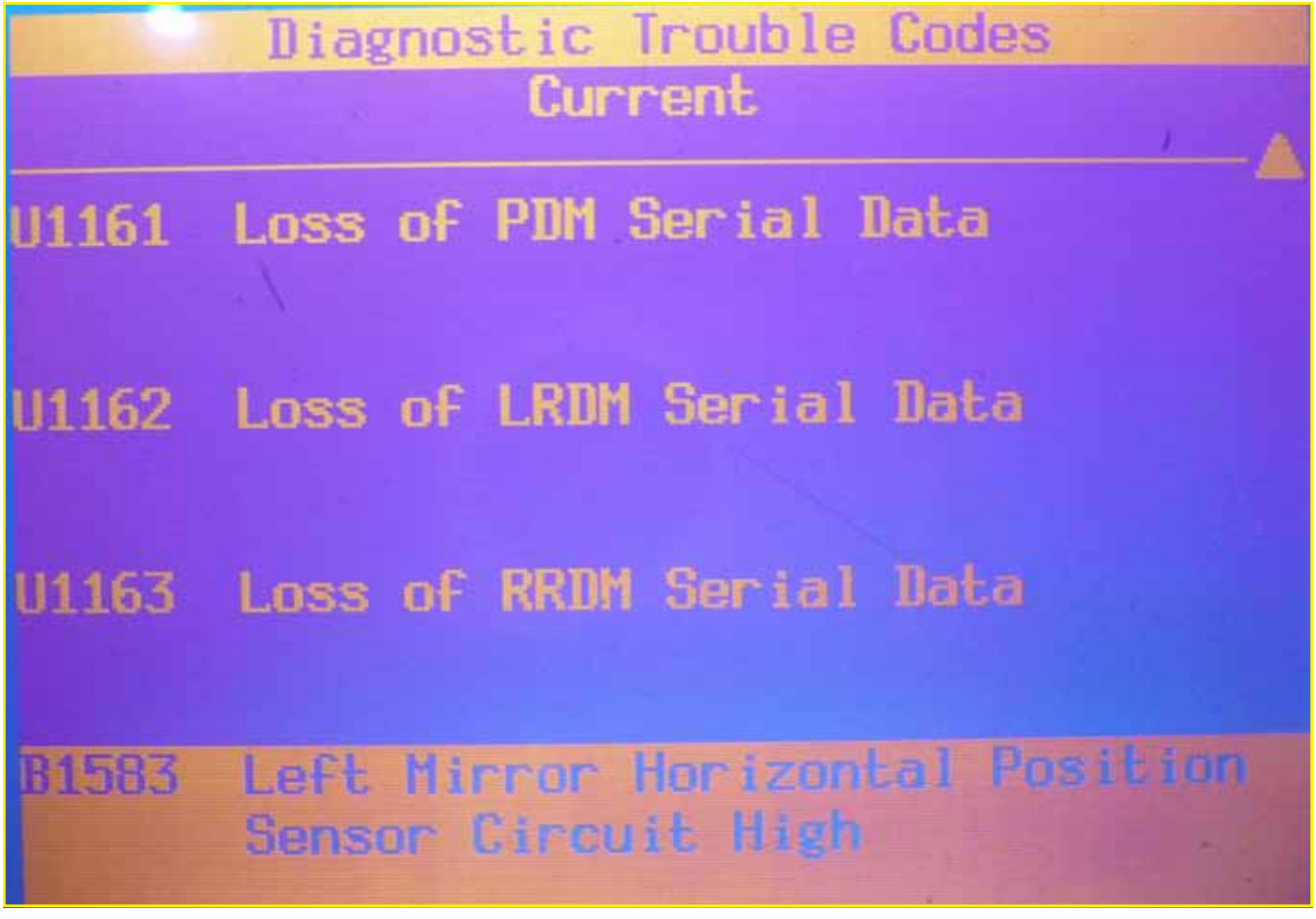
Diagnostic Trouble Codes
Current
U1161 Loss of PDM Serial Data
U1162 Loss of LRDM Serial Data
U1163 Loss of RRDM Serial Data
B1583 Left Mirror Horizontal Position
Sensor Circuit High

Figure 4: "U" codes.

Figure 5: Lifting the rug, noticing a lot of rust build-up on the floor from a prior water leak.

Figure 6: Located a conduit that held the splice internally wrapped with black electrical tape.

Figure 7: Removing the tape, a Scotch Lock connector joined all four UART lines going to the door modules.

connector joining all four UART lines going to the door modules (Figure 7). This connector was badly corroded and was barely making a connection for all the wires to share. I removed all of the wires and repaired the splice. Suddenly, all the windows were working fine.

So, now the recap on this whole scenario. I discovered that the door modules were on a private network with each other and even though they had their own power and ground feeds and switch signals, they all refused to operate when they were unable to communicate with one another. It was a default built into the system. What was amazing to me was why any manufacturer would use a Scotch Lock to connect these wires inside a harness running along a floorboard. Wouldn't it have been better to use a solder joint located in a higher area not so susceptible to water damage? But, then again, who am I to second-guess the engineers? There's always the possibility that this was a field repair done by another shop.

I hope this story has enlightened you to better understand how a network, whether large or small, needs to be in proper order, or things may not work the way they were intended to. Just doing a simple power or ground check at a component does not always validate system integrity. Parts replacers beware!

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A Sprinter at the Start

While a tall, fuel-efficient delivery truck answers many commercial needs, it also presents some new challenges for us in diesel diagnostics and repair.

by Kerry Jonsson

When you first noticed one on the road, you probably thought, "What an unusual looking vehicle." And the first service problem you ran into was likely when your customer needed brakes. "What, you want me to bring them down so you can match them up? Who ever heard of such a thing?" was a common customer response to your likely request. Eventually, parts suppliers learned the difference between Ate and Bosch, so that problem smoothed out. When it comes to diesel diagnosis and repair issues, however, things are not so easy. Given this winter's cold weather, you've probably run into more than your fair share of "no-starts," "hard starts," and "extended cranks." You probably have some experience with American

The PCM won't open the injectors unless it sees a signal from the crankshaft position sensor, which is mounted in the block on the driver's side, by the bell-housing. You can check resistance, AC voltage, and scope the signal to verify that it's working properly.

diesels, such as Ford Powerstroke, Chevy DuraMax, and Dodge Cummins, and may feel pretty comfortable with them. While the same basic principles apply, you can reduce your diagnostic time if you know the particulars of the systems found on the Dodge Sprinter. Scan tool diagnostics used to be readily available to us, but now not so much.

When dealing with no-starts, hard-starts, and extended cranks on pre-2004 Sprinters, you often have to go on a road call and/or tow them in. Or, some incautious person may have tried the dangerous practice of spraying starting fluid or carburetor cleaner into the intake to get the engine started. You've probably heard the appropriate cautions: Leave the key on to time out the glow plugs, and spray while cranking. You may do this every day, but it's our duty to inform you that it's foolhardy. Suppose, for example, that somebody else accidentally cycles the key -- kaboom! While we won't go on record as recommending it, silicone spray is a much safer alternative.

Actually, nobody should have to add an explosive fuel source to get the engine started regardless of the weather. What engineer would allow a non-starter to be produced? You just have to figure out what the problem is. Glow plugs? Fuel delivery? Injection? These 2.7L vehicles use a direct-injection, common-rail diesel fuel system developed by Mercedes-Benz. Instead of the traditional pump timing high-pressure pulses to the injectors, this works more like gasoline EFI, albeit at much, much higher psi. The common rail is continuously supplied with ultra-high pressure, and the injectors are electrically triggered by means of electronic logic. So, there's a computer in control of timing and pulse width. Obviously, that control unit needs to know when to fire the injectors, partially on the basis of signals from crankshaft and camshaft position sensors.

This is the low-pressure fuel sensor. It's mounted under the #1 and #2 intake runner. Since it's a typical three-wire sensor, you can monitor the signal line. Key on, engine off, you should see .5V; cranking/running it should be just over one volt.

The fuel injection control unit is mounted under the driver's side of the dash, to the left of the brake pedal. The crank sensor resides on the driver's side of the engine block toward the back by the transmission bell housing. The engine will not start at all without the crank sensor signal. This sensor is an AC pulse generator. Like most AC pickups, it uses a two-wire design. A good sensor will "ohm out" at about 900 ohms between pins #1 and #2 on the sensor. If you crank the engine at normal speed, you should see about one volt AC. If you're scoping the signal, expect over 4 VAC peak-to-peak. A normal cranking rpm would be about 200 to 220. A weak battery will yield a lower cranking speed and AC voltage output, so check the battery first.

The engine will start without the cam position sensor signal, but you'll have a MIL (Malfunction Indicator Lamp) and a code will set. If you have extended crank time, you still need to be concerned with fuel pressure and the glow plug system. There are two halves to fuel pressure: the low-pressure delivery system that draws fuel from the tank and supplies it to the next phase, and the high-pressure pump that is driven off of the camshaft. The high pressure goes to the fuel rail and distribution pipes that supply each injector. Excess fuel is collected in a

The high-pressure sensor is mounted on the front of the fuel rail. Measure the signal voltage on the center pin -- you should see .5V KOEO. During cranking, it should go to about 1.0V before the engine starts.

manifold at the rear of the cylinder head, and returned through the fuel filter, and, finally, a cooling coil.

The low-pressure system comprises a mechanically-driven pump that draws fuel from the tank through a filter. That is, unless there's a blockage somewhere. A clogged fuel filter from additives and contaminants is a common problem. Additives intended to improve lubricity

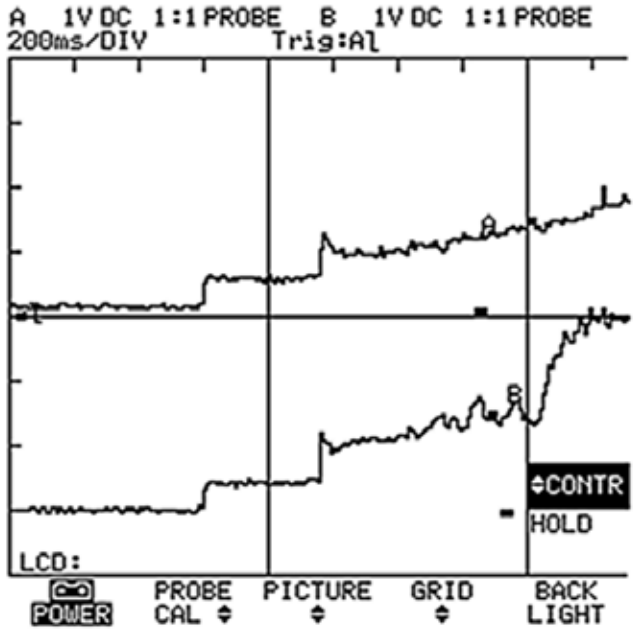
Sprinter injectors are of the direct variety. You can use a "'noid" light to see if they're getting a pulsing signal while cranking. Another test is to remove the return line and crank -- fuel should pulse out of the top. Be careful of the pressure and fire hazard.

can, over time, settle in the filter and restrict flow. Dodge recommends changing the filter every 30,000 miles, or once a year. The water-in-fuel sensor is mounted in the bottom of the filter up to the 2004 model year. It's a three-wire sensor with a 12V reference, 12V signal line, and ground. The signal line gets pulled towards ground when there's water in the fuel.

The purpose of the low-pressure system is to assure that the high-pressure system doesn't run out of fuel when the engine is under heavy loads. Injection pressure may be as high as 30,000 psi (you read that right -- 2,000 BAR!), so a constant supply of fuel is definitely needed. A transparent nylon line feeds the high-pressure pump, so you should be able to see bubbles if there's air in the system. You can check the low-pressure side by splicing a gauge into this feed line. You should see about 17 psi at idle, but it can go as high as 35 to 45 psi while driving. There's also a three-wire low-pressure sensor. On the signal line, you should see .5V with no pressure, and about 2.5V at idle. It can go over 3.0V during acceleration.

The high-pressure side uses a three-piston pump that runs at 1-1/3 the speed of the camshaft. Like those of all other modern "clean" diesels, it generates tremendous pressure, which is injected directly into the combustion chamber. Full pressure is needed to get the engine started, and volume is relatively low, so even small leaks will bleed off enough pressure to cause a no-start. Be very careful when inspecting the high-pressure side for leaks -- wear safety glasses and gloves as there's plenty of psi to penetrate your skin and give you a diesel tattoo. We're not aware of any

gauge outside of engineering circles that can be tapped into the rail to measure this pressure, but it can be monitored by means of the high-pressure sensor mounted on the front of the fuel rail. This is a three-wire sensor with a 5V reference, signal line, and ground. You can see these voltages on your DRB III scan tool, but you'll need the Sprinter Card, a MUX box adapter, and a special red-plug cable. The signal line will have .5V with no significant pressure in the system. While cranking, you should see the voltage rise to about 1.0V as the engine starts. If you do not reach about 875 psi the engine may not start. That's about .875V at the signal wire. If you don't see at least that much, look for external leaks in the high pressure lines. There may also be internal leaks. For example, a leaky injector may keep the pressure from building up sufficiently.



The upper trace is the low-pressure sensor signal, and the lower trace is that of the high-pressure sensor. The first step up in both patterns is the ignition key turned on. The next step is cranking and running. The end of the lower pattern shows an increase in high pressure from acceleration.

There's also a solenoid at the back of the high-pressure fuel rail that controls psi according to load. It's called, logically enough, the Fuel Rail Pressure Control Solenoid, which the fuel injection control unit can close or open to raise or lower fuel pressure according to need. It has an "O" ring at its end. If that should break, it will create an internal leak that will not allow enough pressure to build to allow starting. You may have to physically remove the solenoid to make sure this is intact. If you suspect that an injector is leaking, you can unscrew each injector line one at a time and install a ball bearing to block flow. When you get to the leaking injector, high-side fuel pressure will rise and the engine should start the other four cylinders. If you can't find any internal or external leaks, you may just have a high-pressure pump that is not up to its task.

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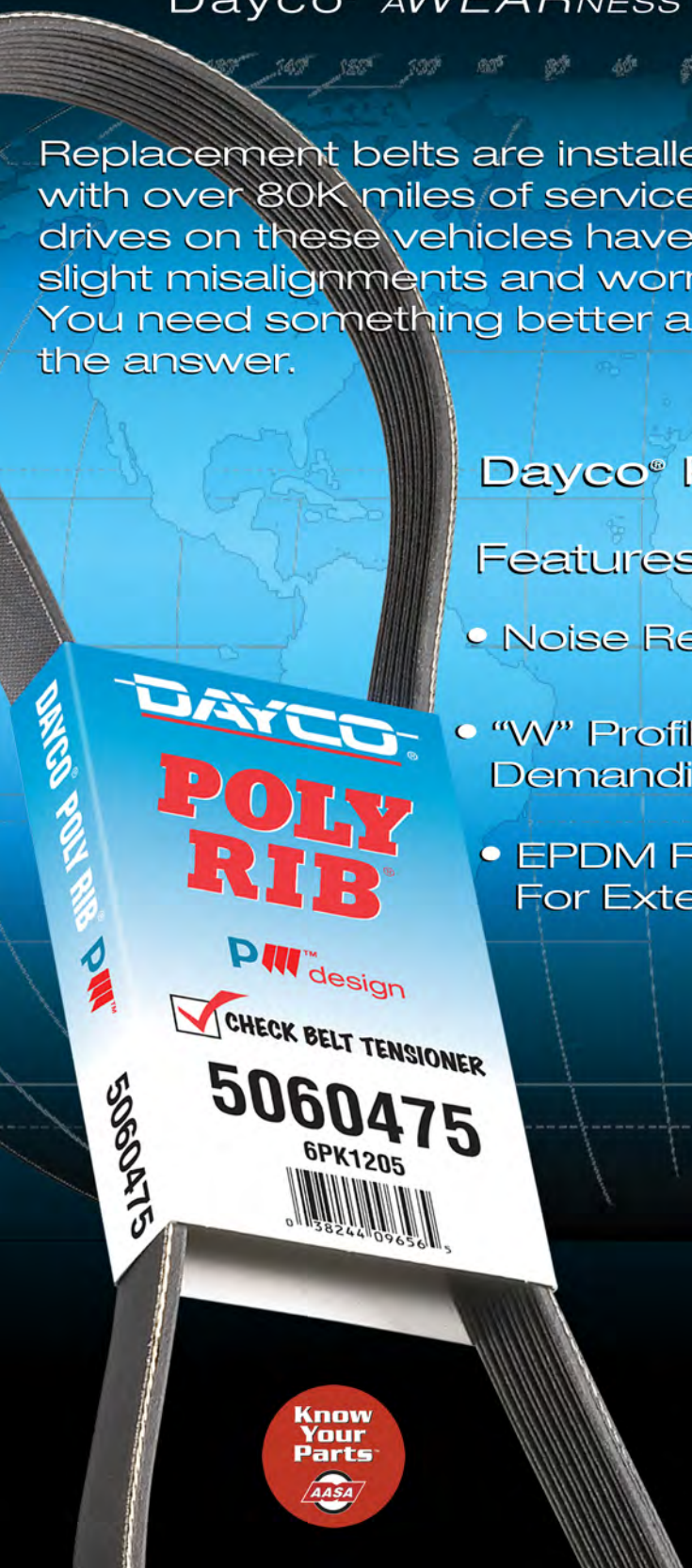

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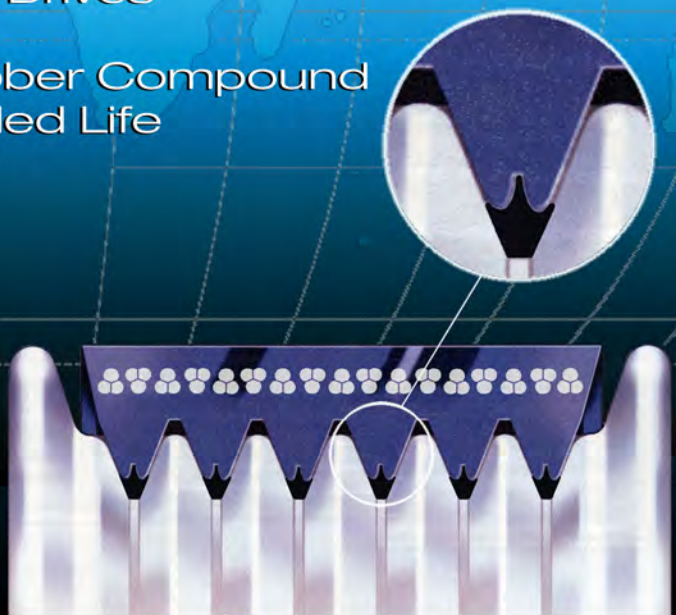

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Dodge has a test for the high-pressure pump, assuming there are no leaks in the system. You start by unplugging the solenoid and checking fuel pressure while cranking. The engine will not start, but you should see about 800psi on your scan tool, or .8 volts on the high-pressure sensor signal wire. Your DMM's display rate may be too slow to give you an accurate reading, so you might want to use a graphing multi-meter, or a lab oscilloscope to watch the voltage. You should see a steady signal above .9V. You may see it spike over 1.0V, but then drop down. The drop indicates that the pump cannot maintain pressure, or has a weak piston. This pressure drop will keep the engine from starting, and you'll have to replace the high-pressure pump. We've noticed that they may start to become questionable at between 90,000 and 100,000 miles.

Of course, the glow plug system can cause a starting issue. On pre-2004 models, the glow plug controller is under the battery tray. It has three connections: a battery power cable, a six-pin connector with five wires (one for each glow plug), and a two-wire connector (one wire is ground, and the other is the signal from the fuel injection control unit for how long to energize the plugs). If you want to measure the resistance of the glow plugs, simply unplug the six-pin connector and check ohms between each pin on the connector and an engine or battery ground. You should see about 1 ohm. These are "pencil" type glow plugs, which heat up very quickly. The draw for each is about 20 amps. If you measure the current on all of them, you will normally see 75 to 100 amps depending on how cold the temperature is.

The signal from the fuel injection control unit to the glow plug controller starts off at 10 to 11 volts with the key on and the engine off. A "wait-to-start" light will come on in the instrument cluster. The CTS (Coolant Temperature Sensor) signal is used to determine how long the glow plugs are energized. The signal will then change to an inconsistent square wave. This is normal as the glow plugs are still pulsed on the first few seconds the engine is running to help with combustion on a cold engine. You can unplug the CTS to get maximum glow plug time from the controller -- be aware that the electric cooling fan will come on as a fail-safe when you do this.

Starting problems can be tricky, but the more you know about the systems involved the more efficient you'll be at troubleshooting. Sprinters are typically fleet vehicles, so any downtime is costing your customers money. A fast and accurate diagnosis will keep them happy with you. What more could you want?

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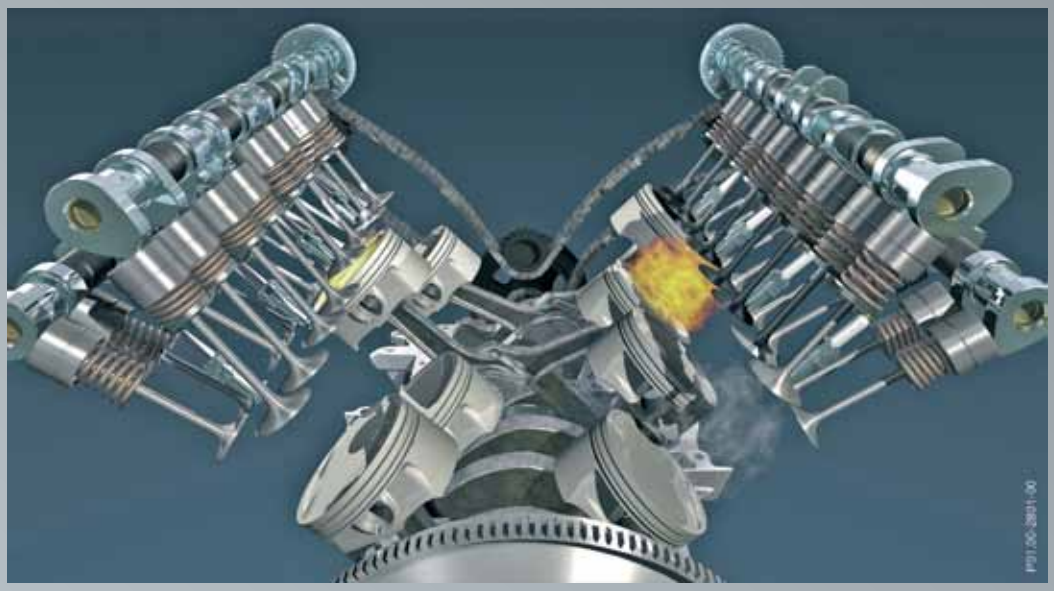

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"This Seat Is Occupied"

by Kerry Jonsson

In the quest for ever-increasing safety, seat occupancy detection systems help by giving the electronics the info needed to determine how to fire the airbags. That system is malfunctioning in this 2005 Chrysler Town & Country. It's our job to diagnose and repair what's wrong.

We've all had to keep pace with rapidly-advancing technology, perhaps especially so with new developments in automotive safety. It seems that every year or so a new airbag gets added -- driver's side, passenger's side, dual-stage, side, curtain airbag, knee bolster, etc. These measures have reduced fatalities and serious injuries, and their resultant medical costs. But they've also been known to kill. Small children and frail elderly people sometimes can't survive the full force of a deploying airbag. For years, the only defense was to relegate such passengers to the back seat. Now, airbag technology has advanced to the point that occupant detection systems measure the weight of the passenger and determine if and how the airbags should be fired.

-- ORC DTCs 1 of 2 --
DRIVER SEAT BELT
TENSIONER CIRCUIT OPEN
MINUTES: 813 IGN CNTS: 9
--- DTC 2 of 2 ---
OCM ACTIVE DTC
MINUTES: 182 IGN CNTS: 0

The primary code led us to diagnose a bad seat belt tensioner, but the second code directed us to a relatively new item added in 2005, the Occupancy Classification Module.

But what if something goes wrong? In the past, we've had to diagnose bad airbag squibs, crash sensors, and clock-springs, but a problem in the detection system was new to us. A 2005 Chrysler Town & Country came in with the airbag light on. While pulling codes, we realized that there are two different systems we can communicate with. On this Town & Country, Chrysler used an ORC (Occupant Restraint Controller -- a.k.a. Airbag Control Module), and an OCM (Occupancy Classification Module -- a.k.a. Occupant Sensor). In earlier years, the ORC controlled both driver's and passenger's side airbags solely on the basis of the seat belt buckle switch status. In 2005, the OCM got input from additional sensors that monitor the passenger's side front seat.

Since we had a warning light, our first step was to pull codes. We looked in the ORC and found two codes: Driver's Seat Belt Tensioner Circuit Open, and OCM Active DTCs. On this particular model, the seat belt tensioner is on the buckle side of the belt assembly, not on the adjustable belt side. We then checked for codes in the OCM. Occupant Classification Undetermined Status, No ORC Messages and OCM Data Transfer Error came up. The ORC code for the driver's side seat belt tensioner circuit was a straightforward diagnosis. Chrysler has a one-ohm resistor tool that you substitute for the tensioner or airbag circuit. You then clear the codes and see if they come back. If they do, you have a wiring or control unit problem. If they don't, replace the seat belt tensioner.

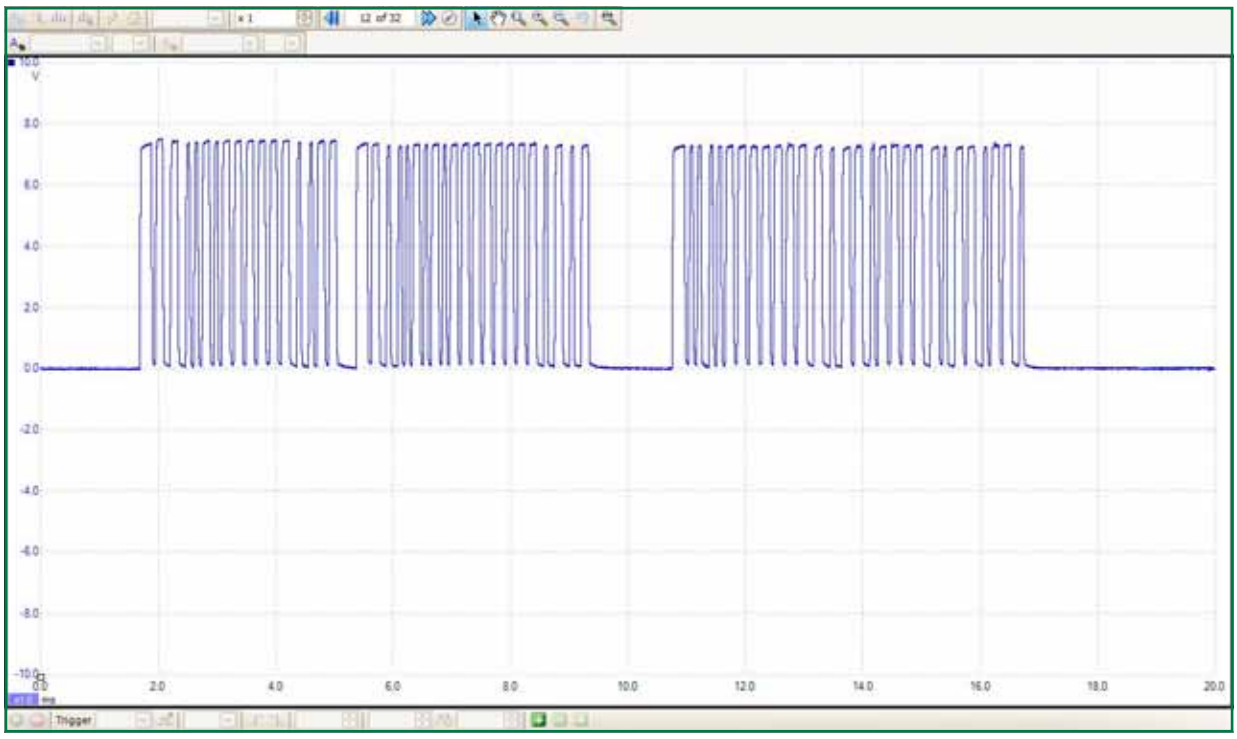
Of course, before doing any diagnostic or repair work you must disconnect the battery for at least two minutes to be safe. You can then unplug the airbags and tensioners and replace them with the one-ohm load simulator to test for codes. If you don't have this special tool, you can also check resistance on individual wires between the ORC and, in our case, the driver's side seat belt

The OCM module is located under the front passenger seat cushion. It gets voltage from the Front Control Module, and relies on both a weight sensor and a seat belt tension sensor to determine how the passenger's side airbags should be fired.

tensioner squib. Keep in mind that there are shorting bars in the ORC computer connector. When it's unplugged the two wires for each squib are shorted together to prevent accidental firing. If you measure resistance between these wiring pairs you should see continuity, which is normal. This vehicle ended up needing the driver's side seat belt buckle, but we had other fish to fry.

The three codes found in the OCM still turned on the light. These codes all dealt with the passenger's side airbag system, the heart of which is the OCM module. This module doesn't fire the airbags, or control the airbag warning light. What it does is monitor if someone is sitting in the passenger side seat and reports this information back to the ORC, which is in charge of deployment. These modules communicate through a single-wire PCI bus. We wanted to verify that this wire was not shorted to power or ground, or open. We checked resistance from pin #15 of the ORC and pin #8 of the OCM and measured just under ¼ of an ohm.

By putting a lab scope on the communication wire, we could see if there was communication, or if there was interference from other voltage



By watching the oscilloscope pattern of the PCI bus we could easily determine that there was communication among control units. The bus links many modules, so it was possible that some other unit was interfering with communications. That should have flagged some other communication code, however.

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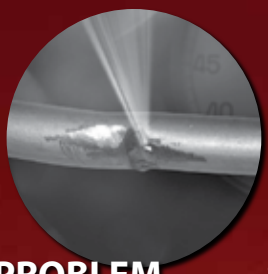

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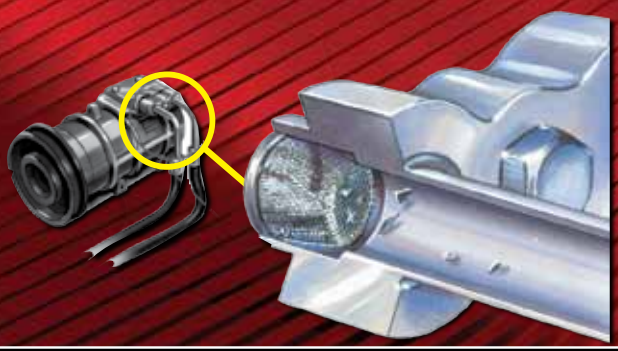

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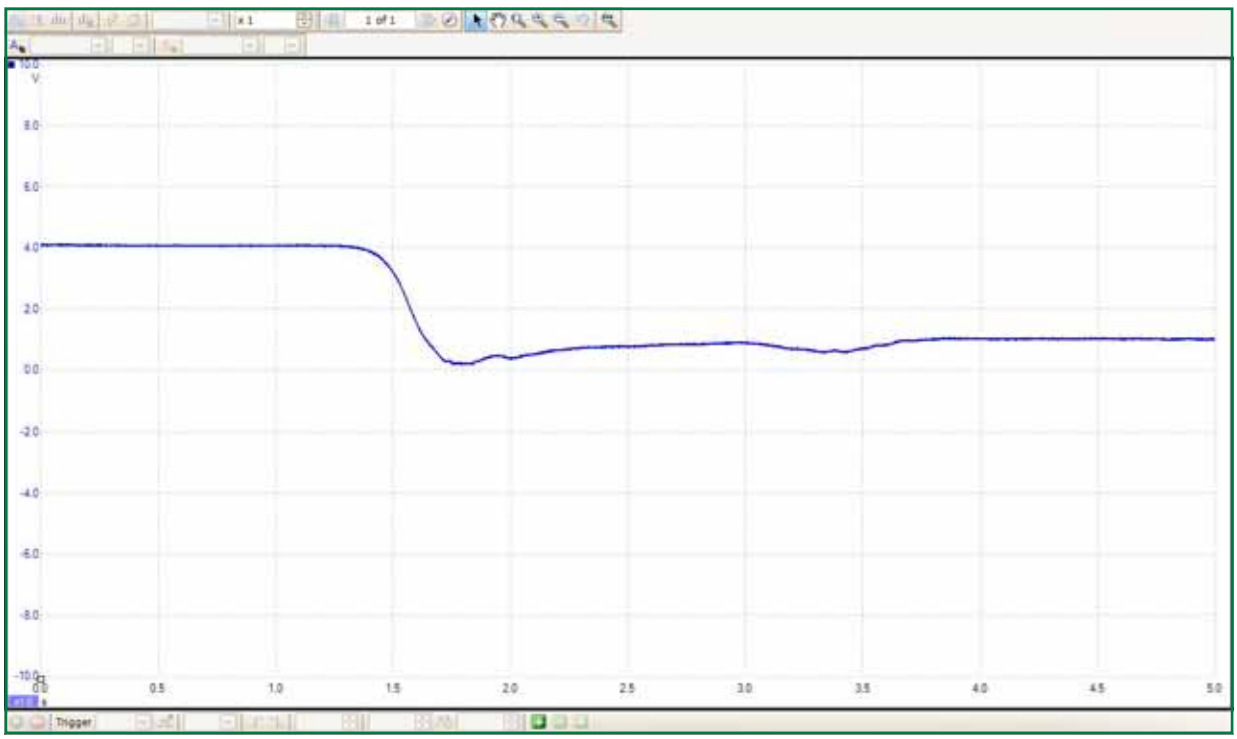
or ground sources. We did see a 7.1 to 7.5V square wave with the ignition key on. This meant the wires were not shorted and the control units could communicate with each other. If there was a communication problem between these two units, it could be because one of the units was malfunctioning, or some other control unit was putting out erroneous data and confusing the others. We decided to check codes in the other control units on the PCI bus, but didn't find any that dealt with a loss of communication. So, we concluded that the communication problem was isolated between the ORC and the OCM units.

We suspected the OCM module because the first code (Occupant Classification Undetermined Status) suggested that it may not be functioning properly. The second code (No ORC Messages) meant that the OCM could not communicate with the ORC even though we could see the communication on the PCI bus. The final nail in the OCM coffin was the last code -- OCM Data Transfer Error. We knew the communication wire was okay, so the OCM itself must have been causing the problem. We wanted to be sure that there were no other outside influences causing the OCM to not work properly. You should always check powers and grounds before replacing any control

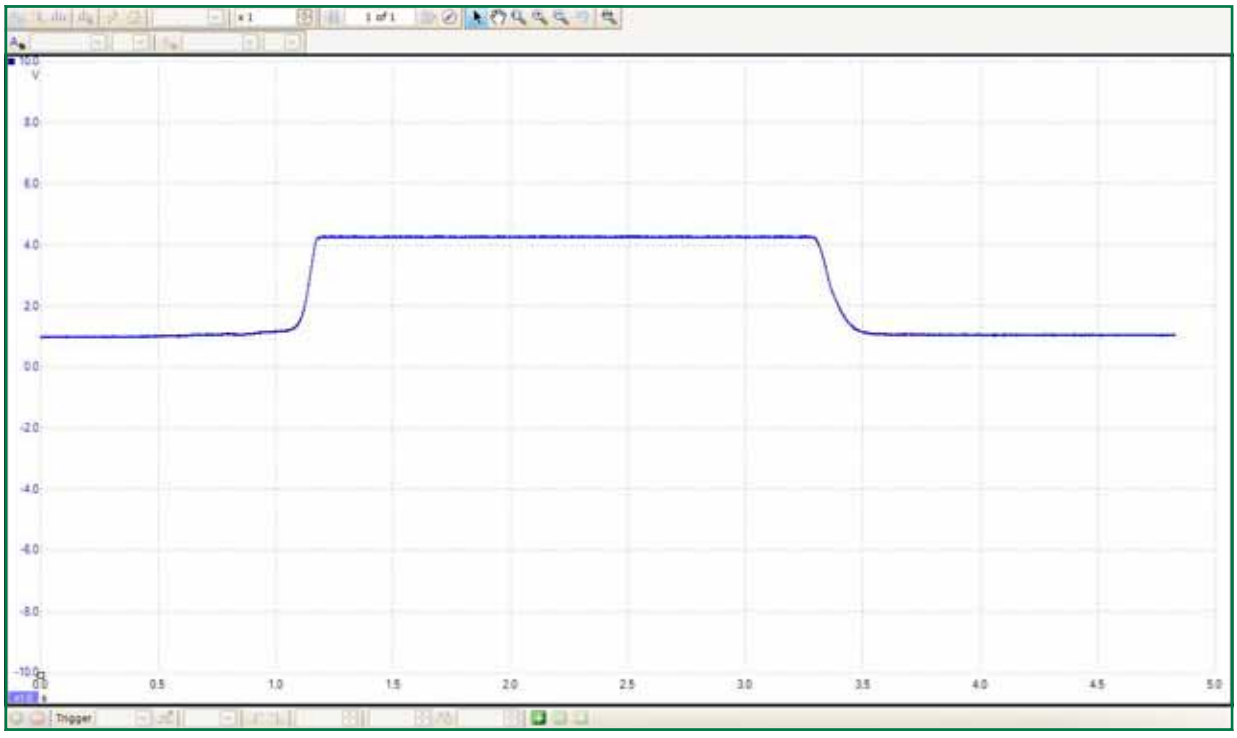


Looking at this weight sensor signal, we see about 4V volts with the ignition key on. The voltage dropped to about 1V with 185lbs in the seat. You can watch this signal voltage with a DMM as well.

unit, but with newer CAN systems that can be tricky.

This OCM is directly grounded through pin #5. The power supply is another matter -- there's no conventional fuse supplying ignition-on power to the unit. A Front Control Module, incorporated into the Integrated Power Module, supplies almost 11V to pin #9 of the OCM when the ignition key is turned on. Without this power-up signal, the OCM may not communicate with the other control units on the PCI bus. In our case, both the power-up signal and ground passed our tests. To further see if outside influences were causing the OCM to fail, we decided to check the two other sensors that provide inputs to the OCM.

The first is a weight sensor in the bottom of the passenger seat. It is a bladder type sensor with three wires for reference voltage, signal, and ground. The reference is 5V and comes from pin #7. The signal comes in on pin #6 and changes with the weight applied to the seat. With no weight, you should see about 4V, and with a 185 lb. man in the seat the signal drops to just about 1V. In other words, the greater the weight, the lower the signal voltage. If you have codes for this sensor, refer to TSB #08-



The seat belt tension sensor is mounted in the lower mount of the belt, so moving the reel will not change the signal voltage. You can check the voltage and pull up on the belt. You should see the signal voltage change from about 1V to 4.3V while pulling.

001-04 on passenger side airbag safety issues and aftermarket parts, such as an add-on cushion, that can interfere with proper sensor operation.

The second is the Belt Tension Sensor. This component also uses a three-wire design. The 5V reference comes from pin #16 of the OCM, and isn't shared with that of the weight sensor. The ground is also separate and comes through pin #14. The belt tension signal comes in on pin #4. With no tension on the belt, you should see just under 1V on the signal line. Pulling the belt out of the B-pillar mount will not cause the signal to change. The sensor reads the tension on the mount side at the base of the B-pillar. Grab the belt near the base and pull up. You should see the signal rise to about 4.3V.

Since the sensors were functioning properly, our repair was going to be the installation of a new OCM. It's mounted on the underside of the passenger seat cushion, and is fairly easy to get to. Even though it's a control unit, it doesn't need to be programmed or coded when installed. However, it is not just plug-and-play, either. You will have to calibrate the weight sensor after installing a new OCM. With your DRB III/Star Scan, or equivalent, you can calibrate the weight sensor, but you are going to have to throw some weight around. It is a three-stage process. You start with an empty seat. You then put 37.5 lbs. on the seat. In the next step you add an additional 10.6 lbs., and, finally, 52.5 lbs.

With a total of five codes in this Chrysler airbag system, we needed to make the customer aware of the hours of diagnostic time that would be needed to be accurate and precise with our conclusions. We must be bold enough to ask for an honest amount of diagnostic time so we don't paint ourselves in a corner. During that time we need to perform all of the testing we can so we can make come to an educated conclusion. We know. With all the new systems springing up these days, that's easier said than done.

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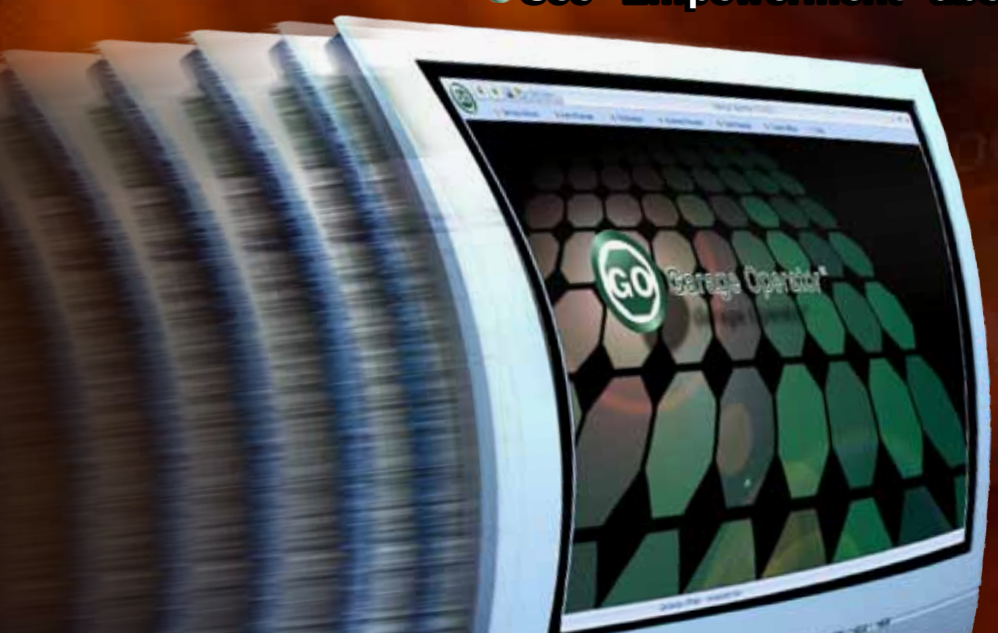

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Cascading Diagnosis

by John Anello, "The Auto Tech on Wheels"

The Jeep's erratic running pointed to the PCM, but what other work had been done recently?

I was called in to a shop for a complaint of erratic engine operation on a 2007 Jeep Grand Cherokee with a 5.7L engine (Figure #1). The engine would run fine with no problems for a while, but at any given moment it would begin to abruptly surge up and down and cut out. The engine could be immediately restarted and would run perfectly again until the next episode. The shop had installed high-performance spark plugs and ignition coils a few weeks earlier, but there were no drivability complaints at the time. The shop even put the old ignition coils back into the engine, but the problem still remained. There were no codes stored in the PCM memory, and the shop did not want to start playing Russian roulette with auto parts, so they called me in for tech assistance.

When I arrived, I attached my Escan generic OBD II scan tool to the vehicle to check for codes -- none were recorded in memory (Figure #2). I started the vehicle and it seemed to run okay, but then it suddenly started to run erratically with a bouncing tachometer. The engine seemed to dip in and out with a near-stall condition. After a few seconds of this, the engine just cut out as if the ignition key had been turned off. I immediately restarted the engine and the problem was gone. I ran it again for quite a while

Figure 1: 2007 Jeep Grand Cherokee

and could not reproduce the problem. It was as if the crank or cam sensor was giving an erratic signal, or the PCM had an internal board issue. I could no longer reproduce the problem, so I offered the garage a free opinion: Try a new crank sensor due to their high failure rate. It would be a cheap fix if it worked.

The shop called back the next day and told me that the crank sensor did not fix the problem and that they had rechecked all the PCM power and ground feeds. The shop was willing to try a new PCM since the problem was so intermittent and everything seemed to lead to an erratic computer. I agreed to program the new PCM for them in hopes that the problem would go away. I could not think of anything else that could cause such an erratic problem. I went there the next day after the new PCM was delivered to program it with new software and configure it to match the vehicle. I started the Jeep and it ran fine for the first 15 minutes, but then it went back into its dance. At this point I got that feeling we all get when we realize that there is an expensive unneeded part installed that someone has to take the blame for. At this point, the shop I were both now married to the vehicle, and we

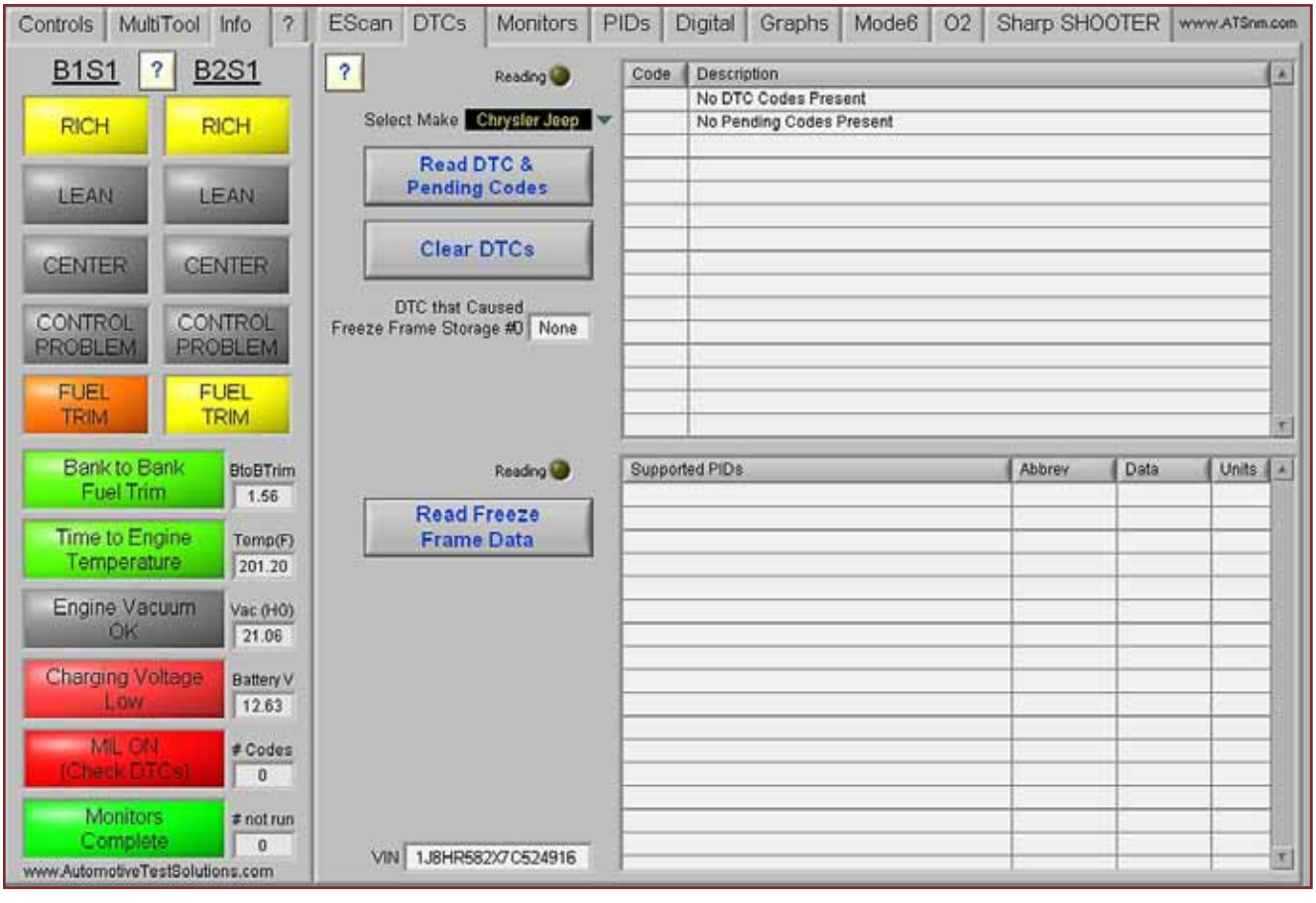

Figure 2: EScan shows no codes in memory

had to find the problem or this PCM was going to be this evening's meal.

I knew my timeframe was short for finding the culprit because I had no idea how long the problem was going to stick around. I quickly placed my Escan tool on the vehicle and graphed some PCM parameters to see if anything looked unusual or out of range (Figure #3). I was monitoring the rpm, MAP and TPS sensors and could see the engine rpm going into an idle roll. But then something unusual happened -- I lost communication with the PCM as the problem got worse (Figure #4), then the engine cut out. This had to be a loss of power or ground to the PCM, or possibly a reference voltage feed momentarily shorting to ground because the PCM was shutting down operations at the same time as it decided to no longer communicate with my scan tool. The only way I was going to nail this problem would be with a multi-trace scope to watch as many signals as I could before this problem decided to go away.

I used my eight-trace Escope and quickly selected six main items that would help me pinpoint the problem using my different colored leads as

Figure 3: Graphing data parameters

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follows: white for PCM battery feed, blue for PCM ignition feed, red for PCM Auto Shutdown Down relay feed, purple for ASD relay coil driver, yellow for 5V reference, and green for PCM ground. As the engine started to run erratically, I captured my first event (Figure #5). I could see that the ASD relay driver momentarily was released by the PCM under 50ms, but I never lost my 5V reference, or my powers and grounds. It was as if something was telling the PCM to let go of the ASD relay coil, so I now had to dig a little deeper. I wanted to see if I was losing a cam or crank signal, so I captured two more events using my green lead for the cam signal (Figure #6) and my yellow lead for the crank signal (Figure #7). Neither waveform pattern showed a loss of cam or crank signal when the ASD relay was being released, but the tachometer was definitely following the cutting in and out of the engine.

I had an eight-trace scope, so it was to my advantage to monitor all eight ignition coil primary circuits to see if any coil trigger was dropping out. I moved all my leads to the coil drivers and continued to monitor the engine's operation. Today was my lucky day because this problem was only getting worse and it decided to

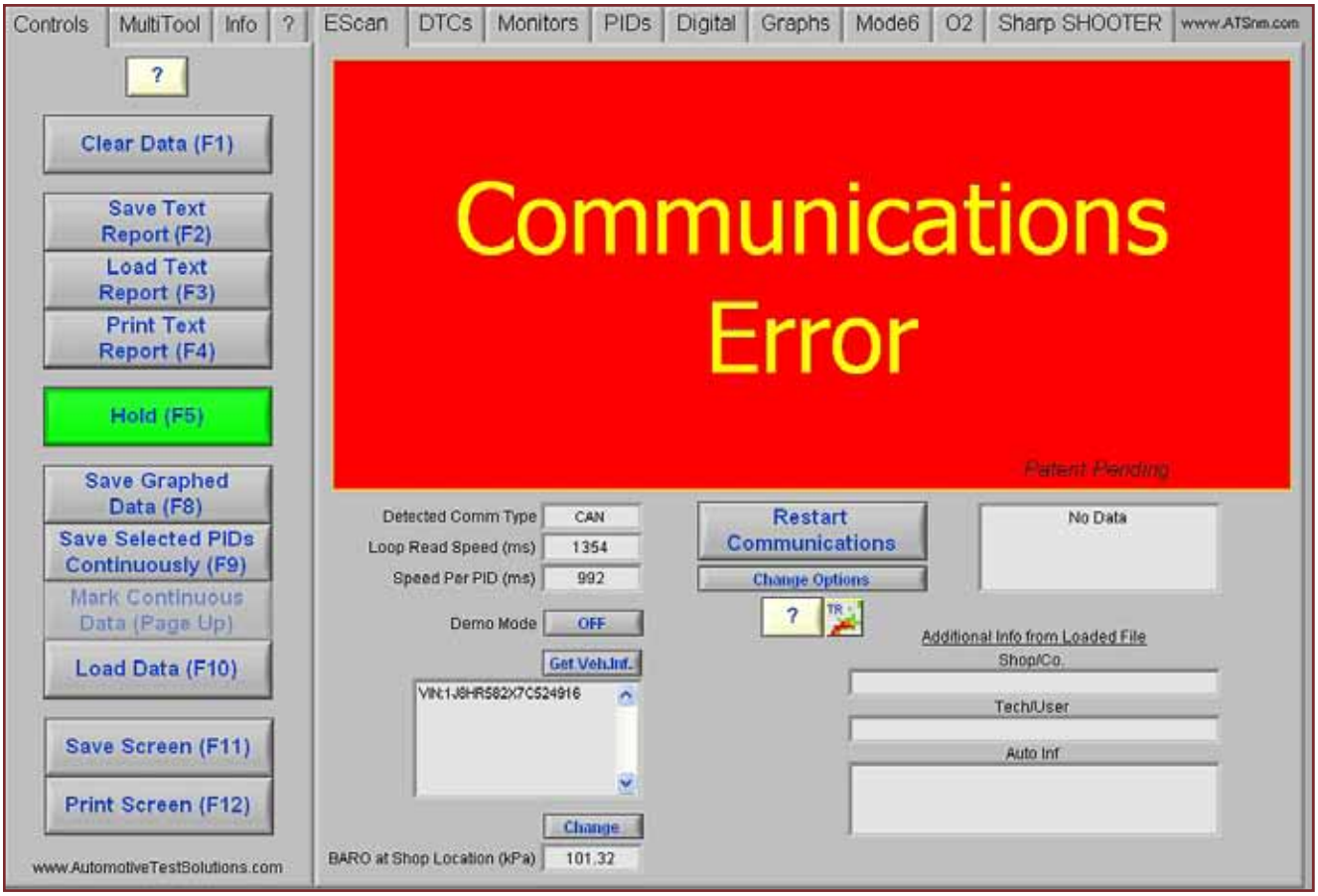


Figure 4: Loss of scanner communication

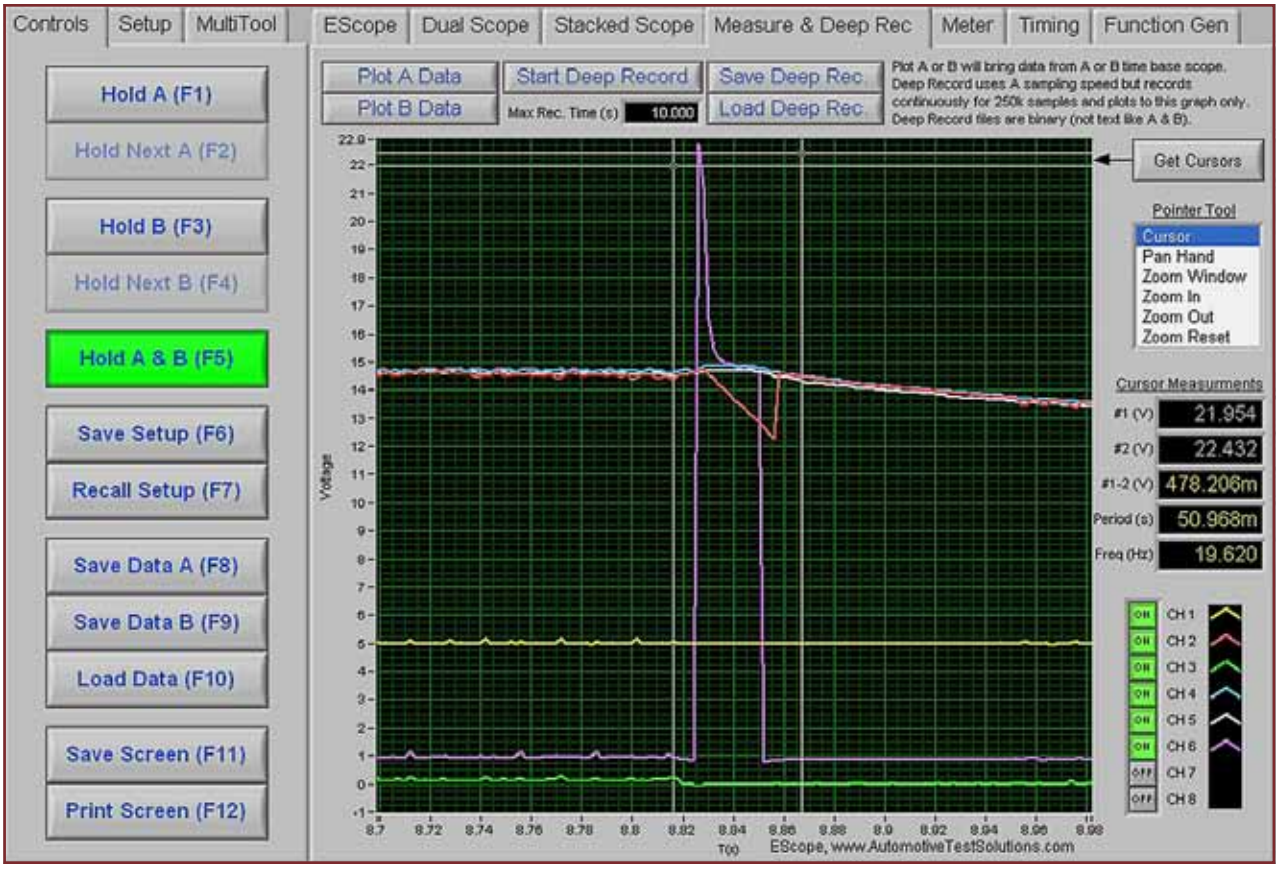
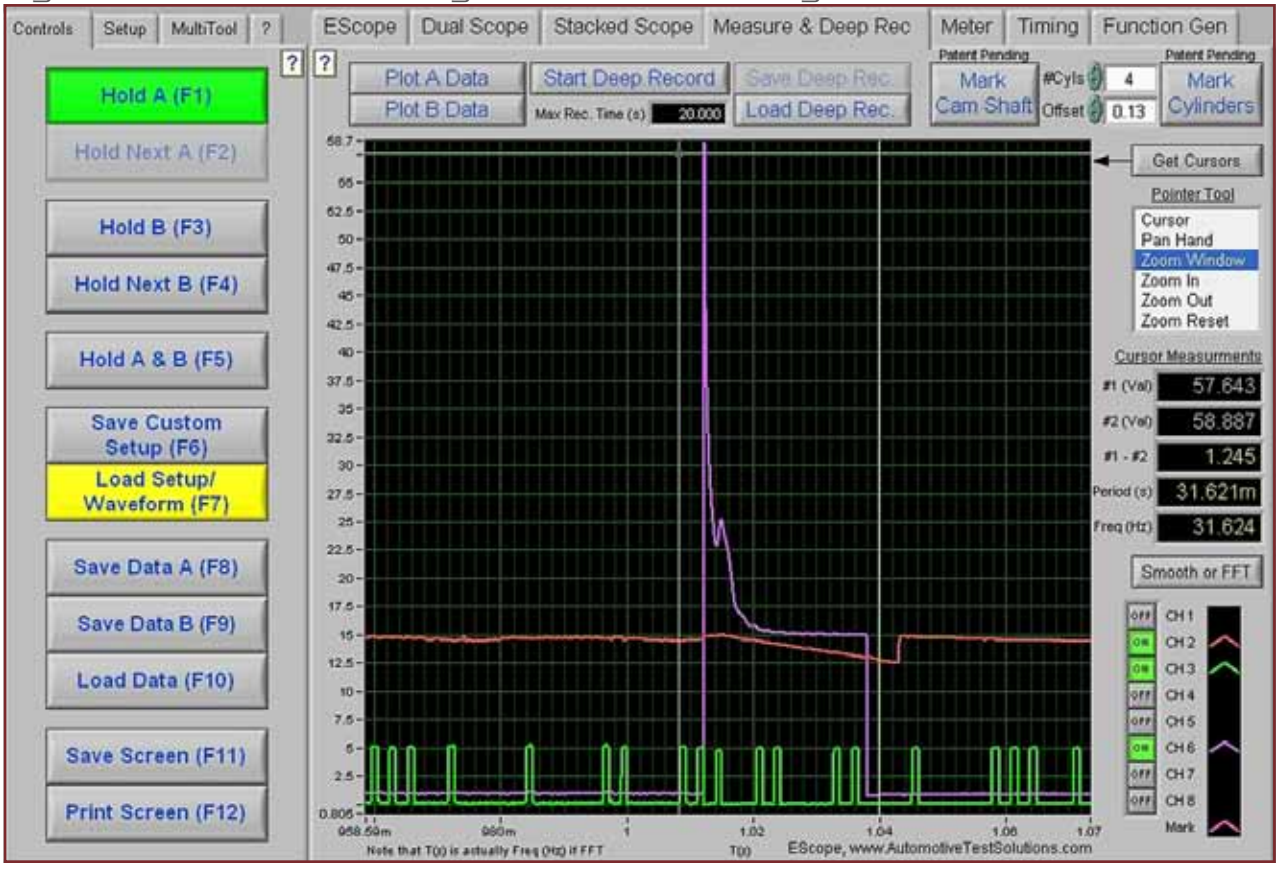


Figure 5 (Above): ECM releasing ASD relay coil
Figure 6 (Below): Checking for loss of cam signal



stick around and give me a joy ride. When I captured another event (Figure #8), I was surprised to see that I was losing all eight coil drivers at the same time. The PCM was letting go of the ASD relay coil and it did not start to trigger the ignition coils again until about 300ms later. There was something making this PCM halt all operations momentarily, or I possibly had a bad new PCM on hand. It would not be the first time I have come across a defective new part.

I decided to call Bernie Thompson from Automotive Test Solutions just get his opinion on things because everything I have done so far has lead me to erratic PCM operation and I just could not pinpoint the cause. I could see what the PCM was doing, but what was its reasoning? Bernie basically wanted me to go back to my scope and look below the zero line for any secondary voltage kickback that could cause a PCM-reset condition. That's when outside noises penetrate the PCM through electromagnetic interference and disrupt its normal algorithms, making it momentarily skip a beat. The engine in no way or fashion had an engine misfire due to a bad ignition coil or spark plug, but it still seemed like a logical possibility.

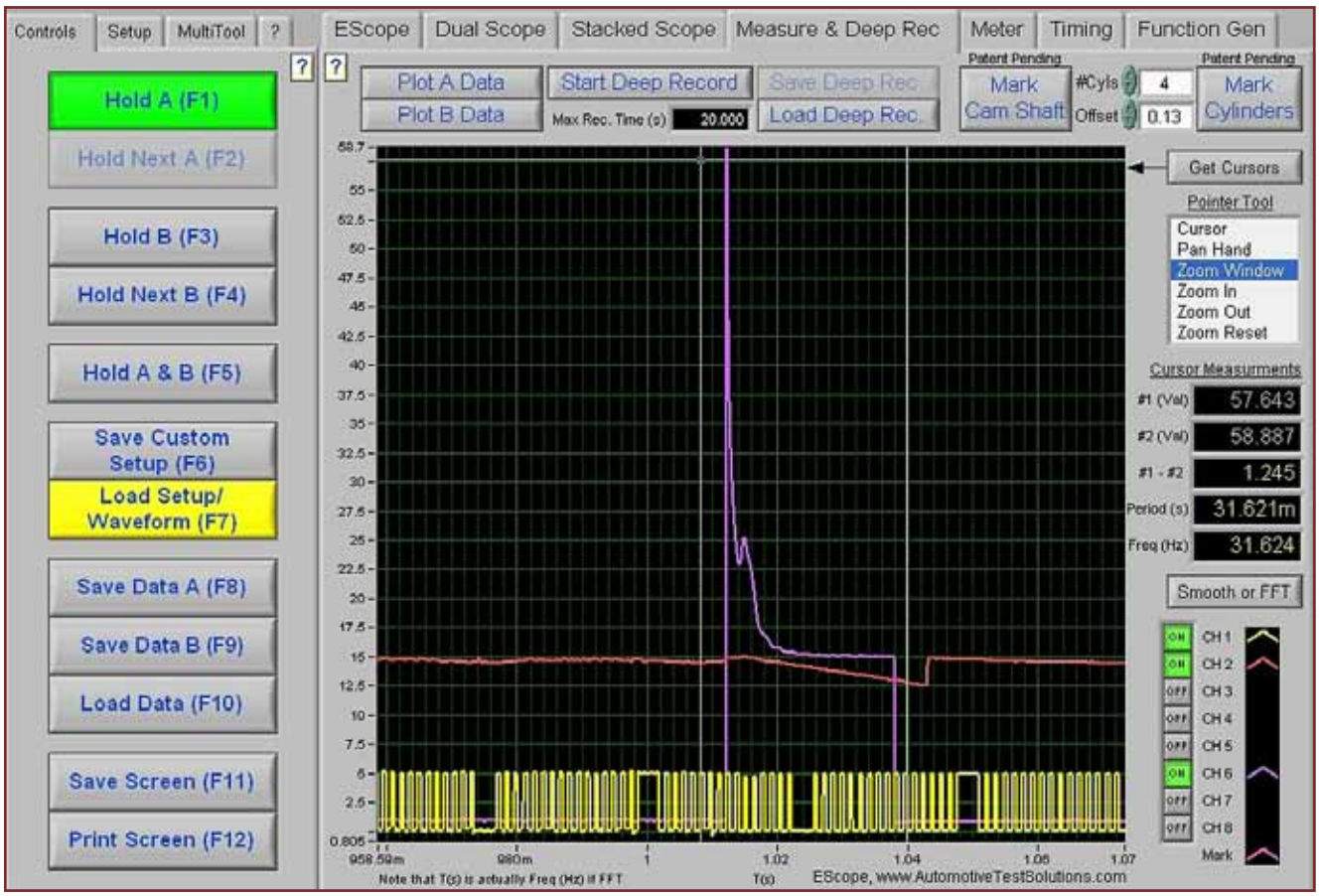


Figure 7: Checking for loss of crank signal

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I went back to my primary pattern and this time lifted it off the zero line to expose any activity below (Figure #9), and I was surprised to see multiple cylinders getting hit with secondary kickback voltage. Cars using PCMs that directly control coil primary may have a little secondary kick that may not have any effect on PCM operation, but if the kick does get great enough it could give the PCM a momentary heart attack and make it skip a beat, or, worse, do permanent damage to the PCM or an internal coil driver.

I knew the original coils were put back in, but I was not so sure about the spark plugs. I had the shop pull a spark plug to get a look at what was currently installed in the engine. I then compared that spark plug to the original (Figure #10), and there was something funky about it. It had a triangle-shaped electrode for a special performance feature it offered. I had the shop remove all the spark plugs and put factory spec spark plugs back in. Once this was done, the problem was completely resolved.

I can only tell you that I was taken aback by this turn of events. It is just so hard to believe that a company could manufacture

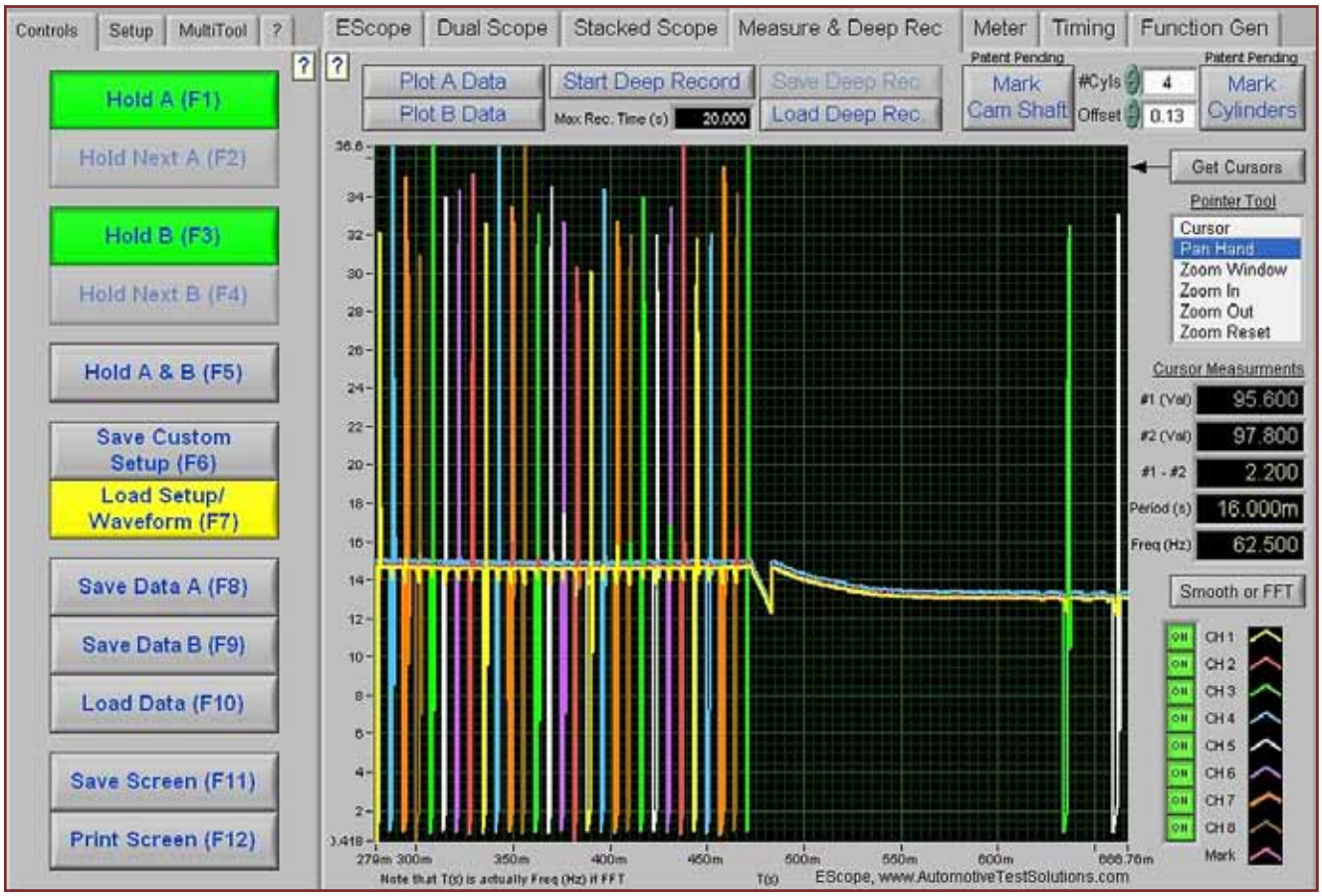

Figure 8: Scoping all 8 coil drivers

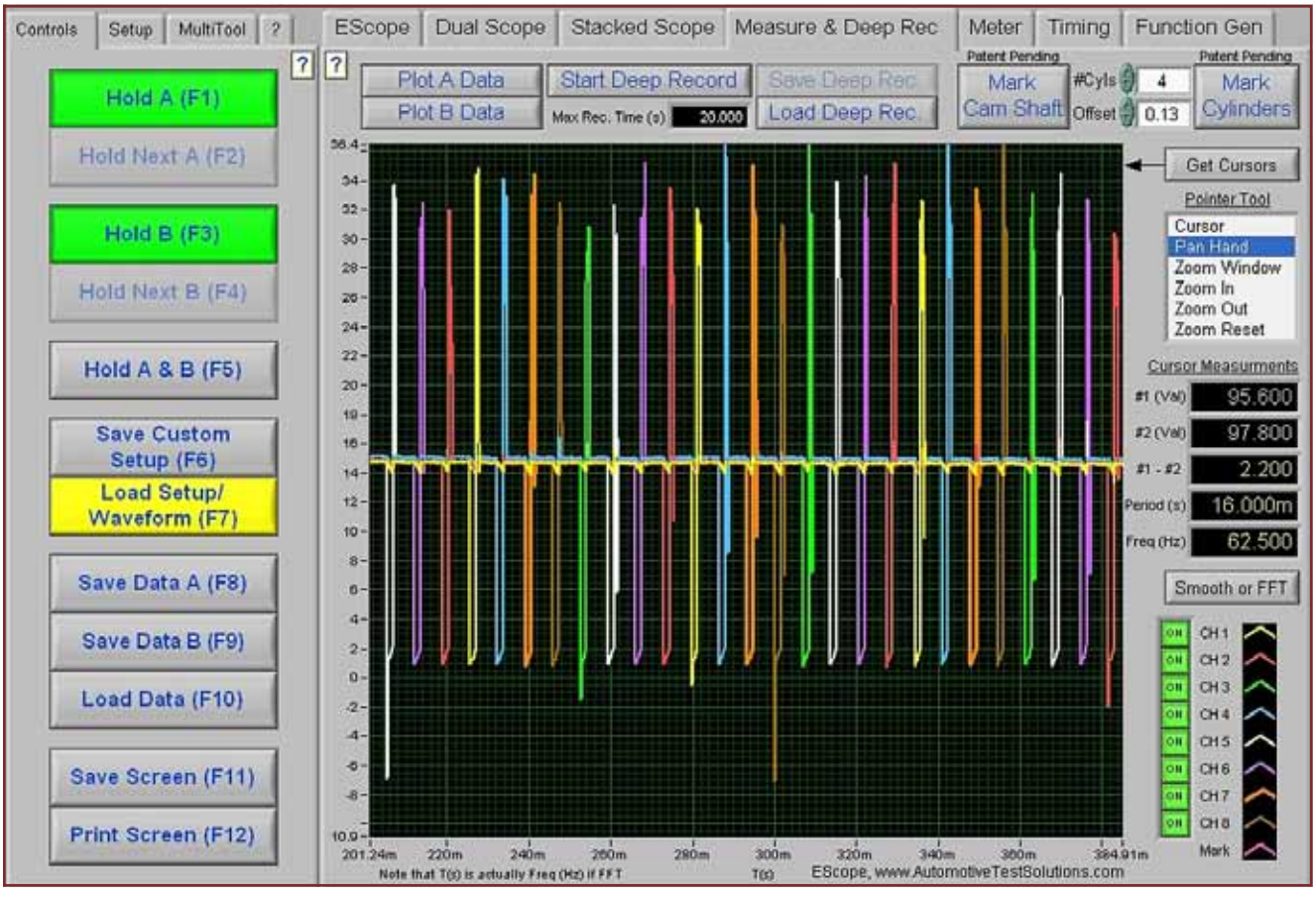

Figure 9: Secondary KV spikes present

a spark plug for performance purposes without any regard to its effects in a coil-over-plug environment. The problem it created mimicked a failed PCM that any tech would have automatically changed in the field. There were no codes, no sensor failures, or wiring issues. A multi-trace scope would have to be used to find a cascading effect of events that would point you in the right direction. I own many one-, two- and four-trace scopes, but with so many circuits involved with onboard control modules today, it sometimes makes more sense to use a bigger net to throw at a problem rather than fishing around with only a few hooks.

Figure 10: Comparing performance spark plug

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Small Businesses May See Some Relief in the New Health Care Act
by Mary Louisa L'Hommedieu, Esq.
The new Health Care Act will affect nearly every small business. The main provisions of the Act roll out over the next four years, with the major changes occurring in 2014. Most notably, beginning in 2014, businesses with more than 50 employees (or full-time equivalents) must provide affordable health insurance for their employees or face penalties. Businesses with fewer than 100 employees will be permitted to participate in insurance exchanges, to be set up in each state, where a pooling of resources should drive the costs of insurance down. And while small businesses are not required to offer insurance for their employees, the Act provides strong incentives for them to do so.
Until the Small Business Health Options Programs - or SHOP insurance exchanges become
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Questions/Comments:
Contact Us via Website or
Call Chris Ayers Jr
484.472.8441